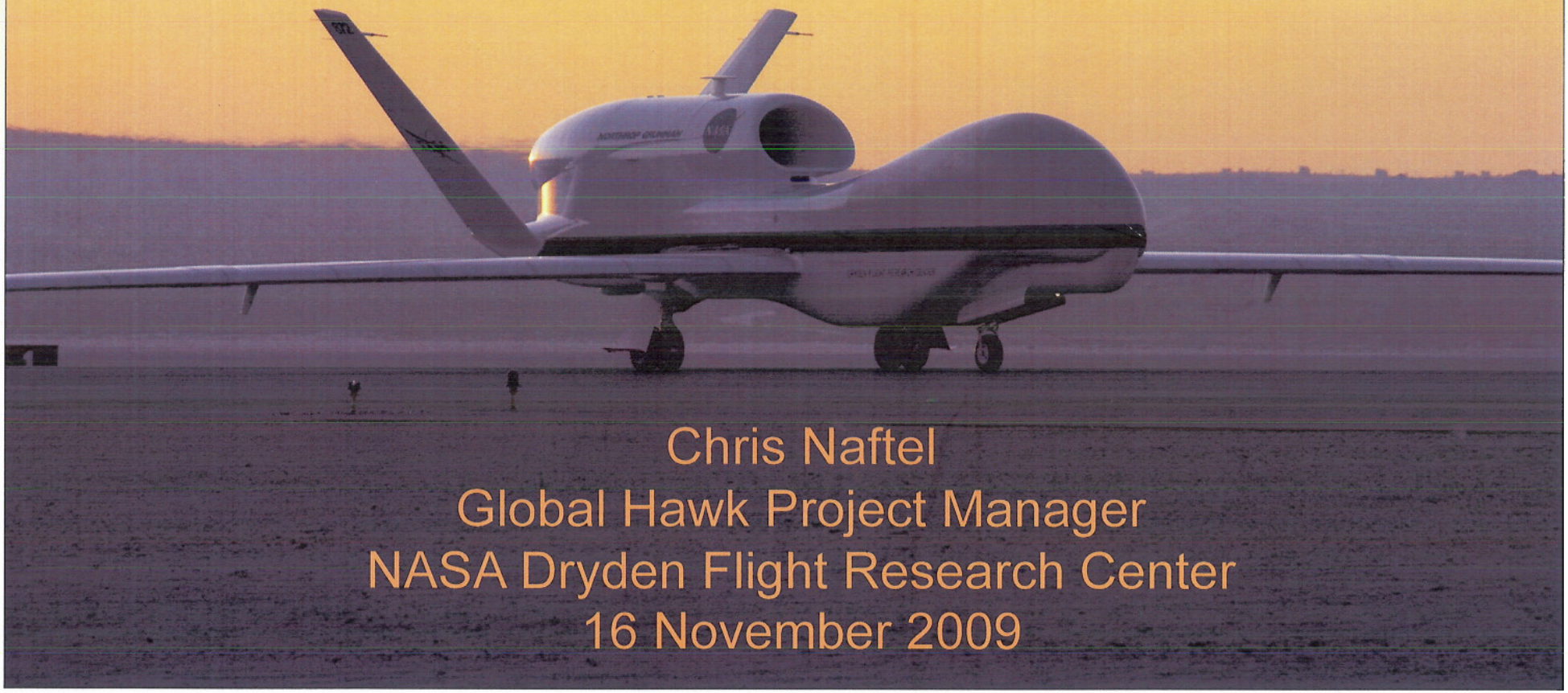
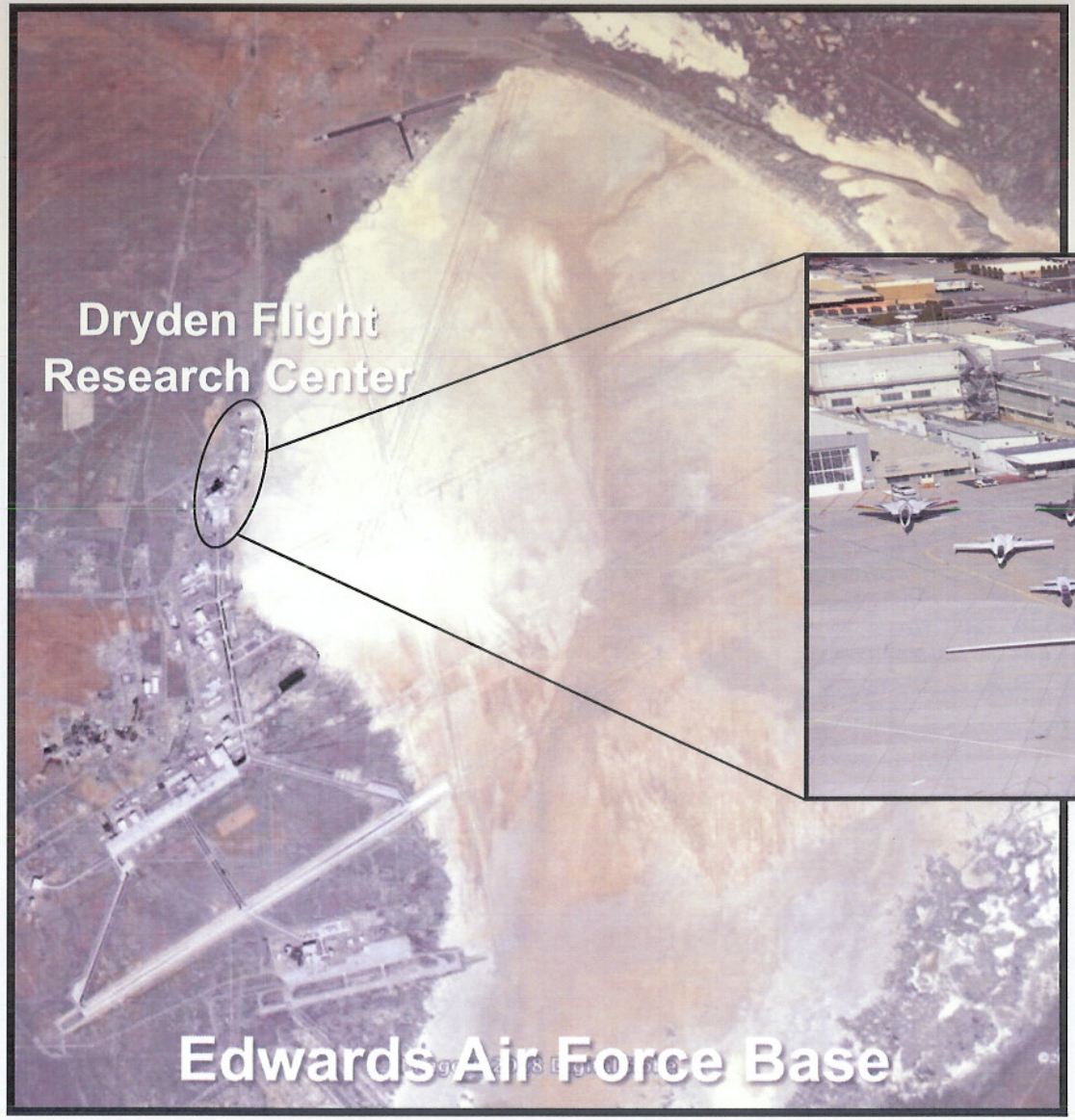
NASA Global Hawk Project Update and Future Plans

A New Tool for Earth Science Research



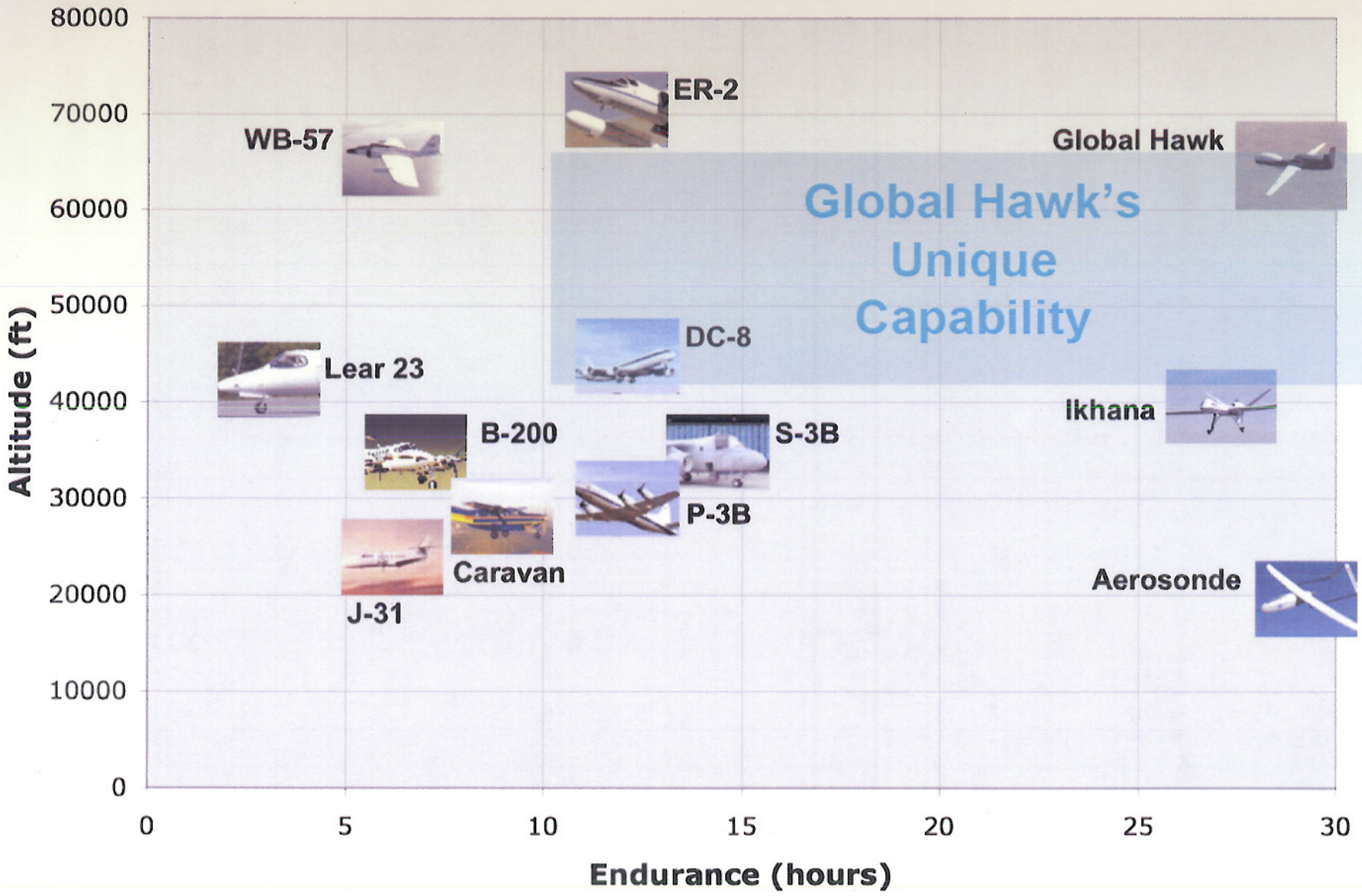
Chris Naftel
Global Hawk Project Manager
NASA Dryden Flight Research Center
16 November 2009

Edwards Air Force Base and NASA Dryden Flight Research Center



NASA Dryden Aircraft Fleet
(as of November 2008)

NASA's Airborne Science Aircraft Capabilities

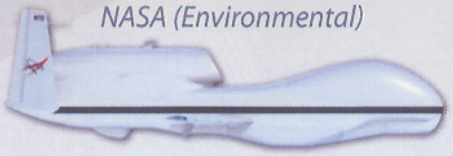


USAF Global Hawk Block Approach

BLOCK 0 (ACTD)

- 7 Aircraft with ISS (EO/IR/SAR)
- First flight FY98, GWOT in FY02
- 2 Transferred to NASA for Environmental Research in FY07
- 1 USAF Test Bird at Edwards AFB

NASA (Environmental)



BLOCK 10

- 7 AF; 2 Navy aircraft
- Raytheon ISS (EO/IR/SAR Sensor)
- Operational in CENTCOM Jan 06
- Training & MCE at Beale AFB

BLOCK 20

- 6 USAF aircraft
- Raytheon Enhanced ISS (longer range)
- NG-ES LR-100 ELINT
- IOT&E and Fielding in 2009

NGC / NASA Partnership

NASA Space Act Agreement:

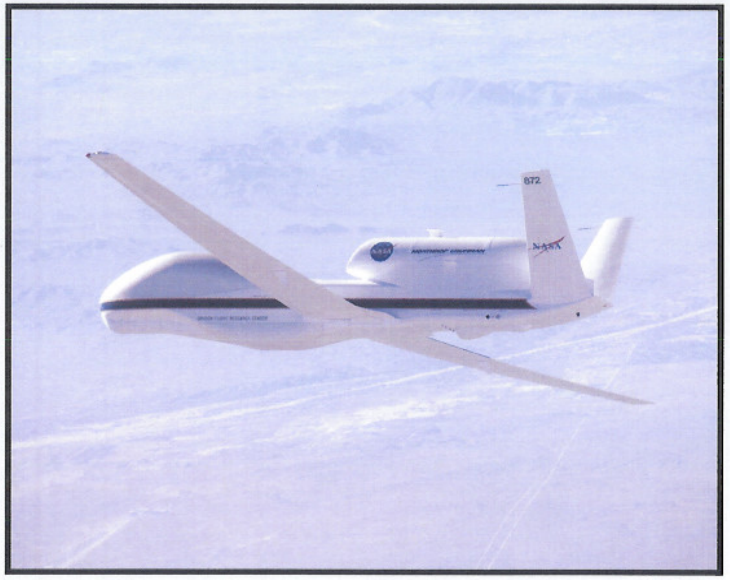
- 2008 – 2013: Share costs and system access.
- NASA focus is Earth & Atmospheric Science.
- Northrop Grumman focus is new capability developments and DoD customers.

Currently in Stand-Up Phase

- Assembled new infrastructure.
- Phase inspections and aircraft modifications.
- New ground control station completed
- Flight testing is on-going.

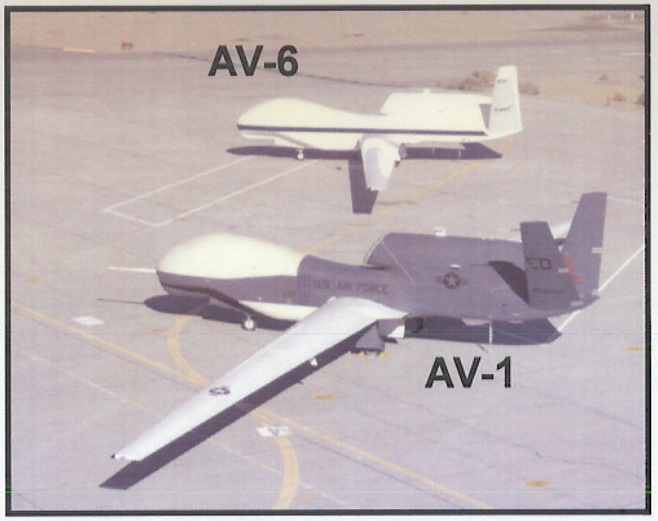
Flight Missions Planned

- January 2010 - Global Hawk Pacific (GloPac) Scientific Campaign.
- Summer 2010 Tropical Storms- NASA Genesis and Rapid Intensification Processes (GRIP).
- 2011 - NASA Jet Propulsion Laboratory UAVSAR.

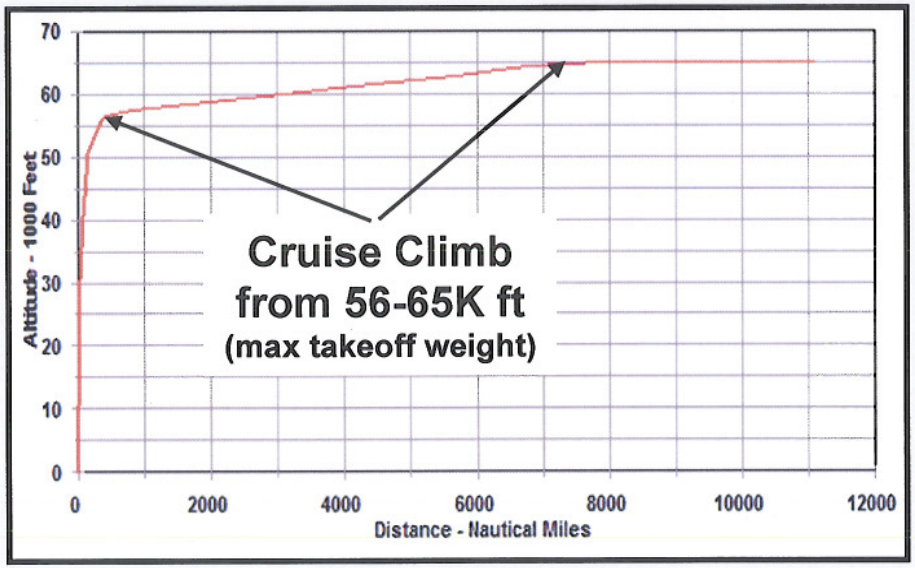


NASA Global Hawk System

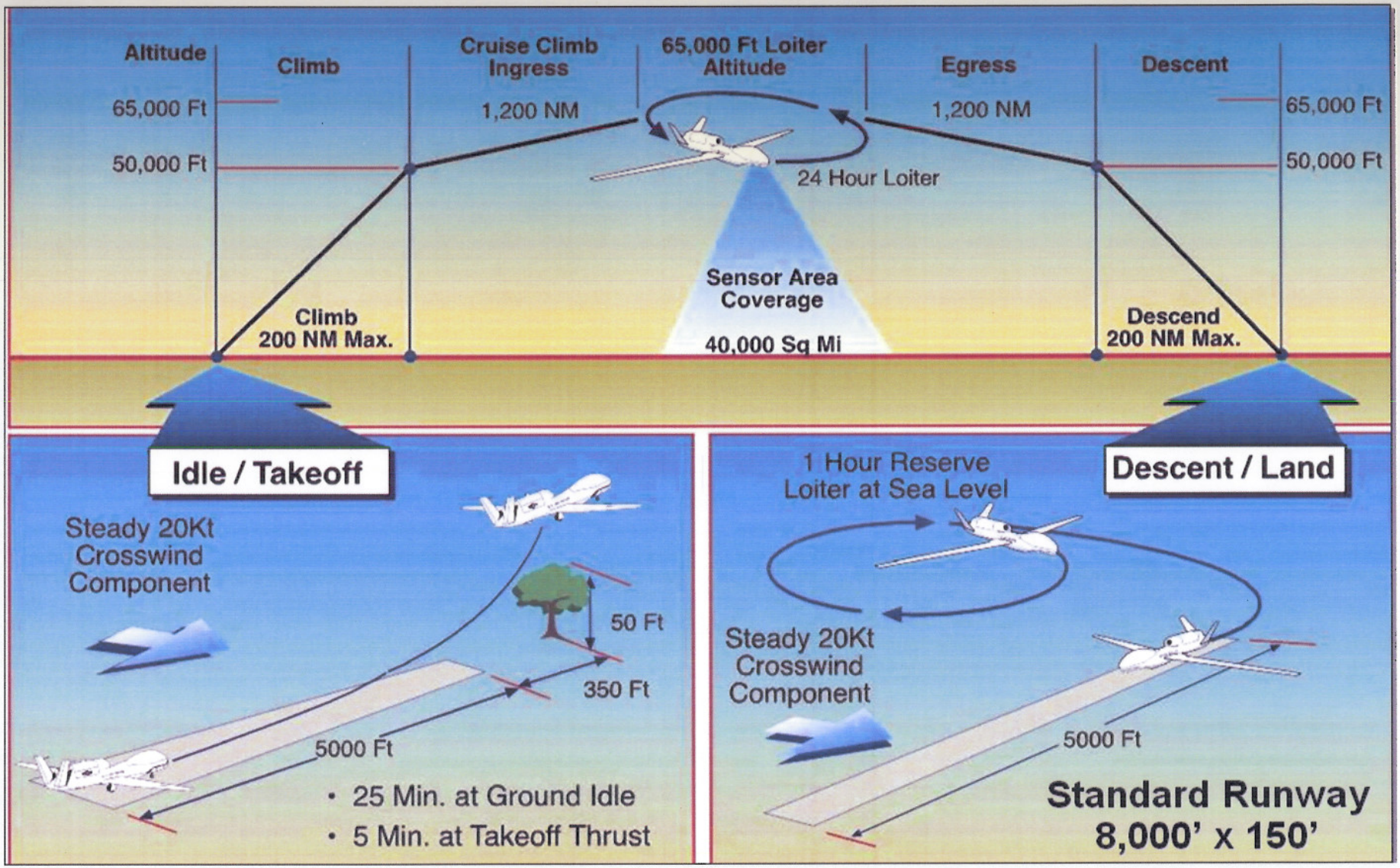
- **Two USAF Pre-Production Global Hawk aircraft were transferred to NASA in September 2007. (A third aircraft arrives later this Fall)**
- **A combined NASA/Northrop Grumman team is maintaining, modifying, and operating the UAS through a 5-year partnership. (2008-2013)**
- **The first flight of the NASA Global Hawk occurred on 23 October 2009. The flight lasted 4 hours and reached 61,400 ft with no anomalies.**



Endurance	> 30 hours
Range	>11,000 nmi
Service Ceiling	65,000 ft
Airspeed (55K+ ft)	335 KTAS
Payload	1,000-1,500 lb
Length	44 ft
Wingspan	116 ft

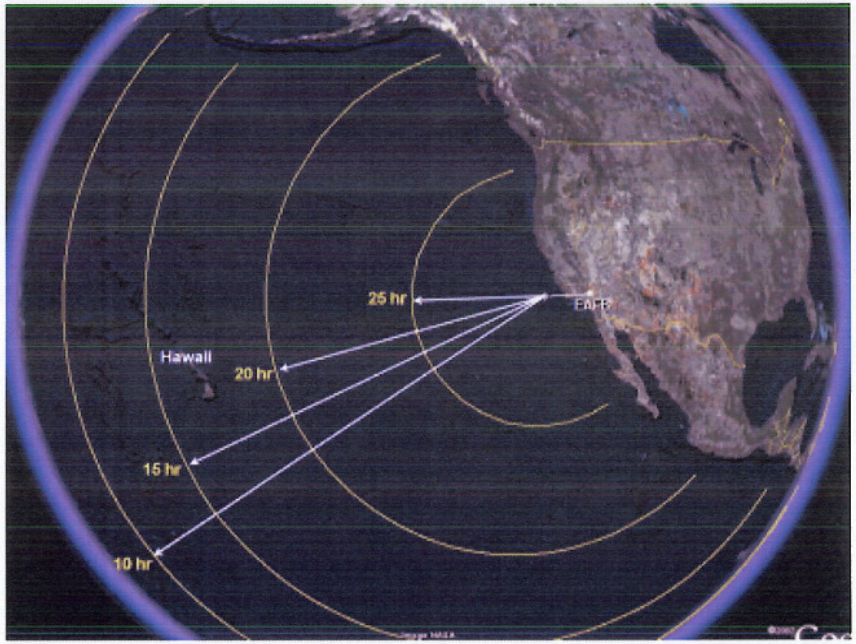


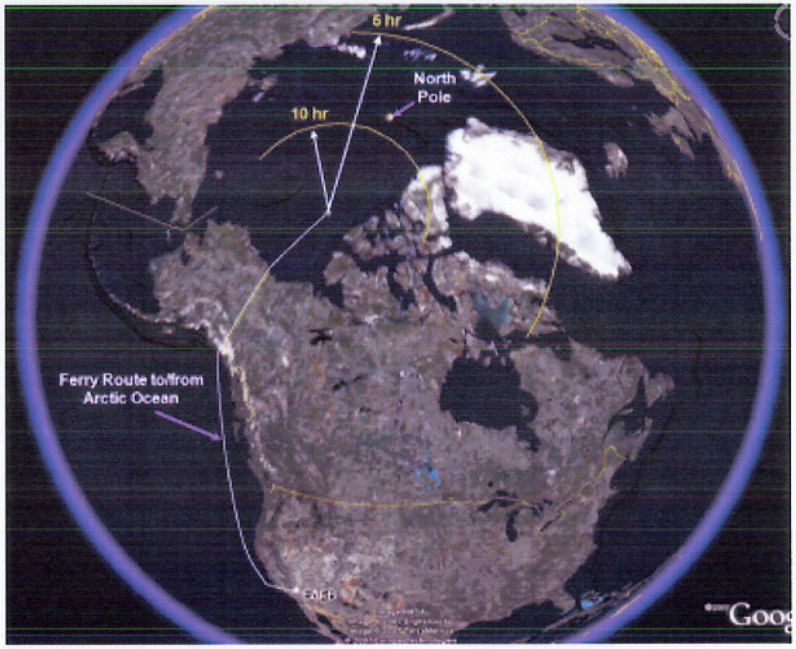
Typical Mission Profile



Baseline Mission Capability

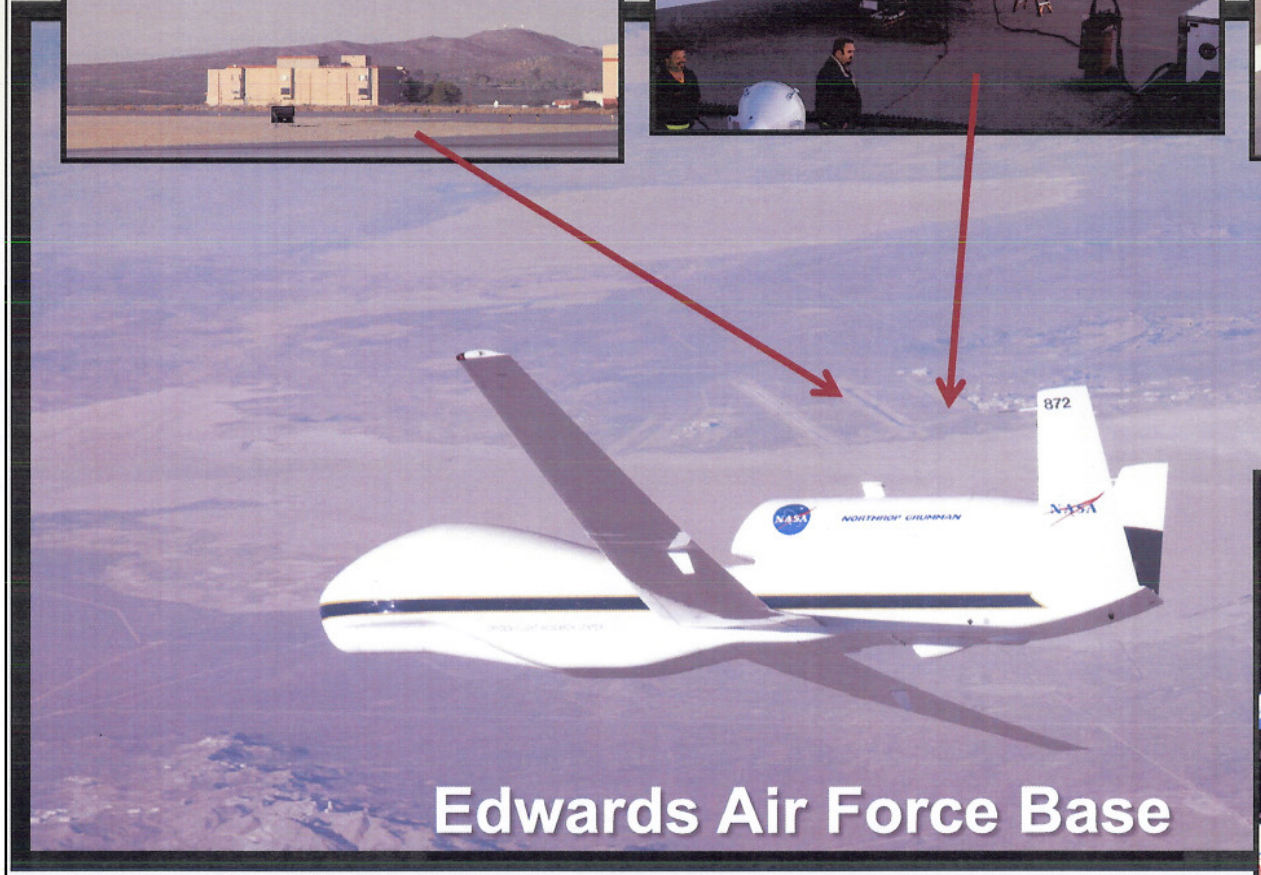
- Long-duration missions will be conducted in the Arctic, Pacific and Western Atlantic Oceans.
- The arcs represent on-station dwell times before return to base.



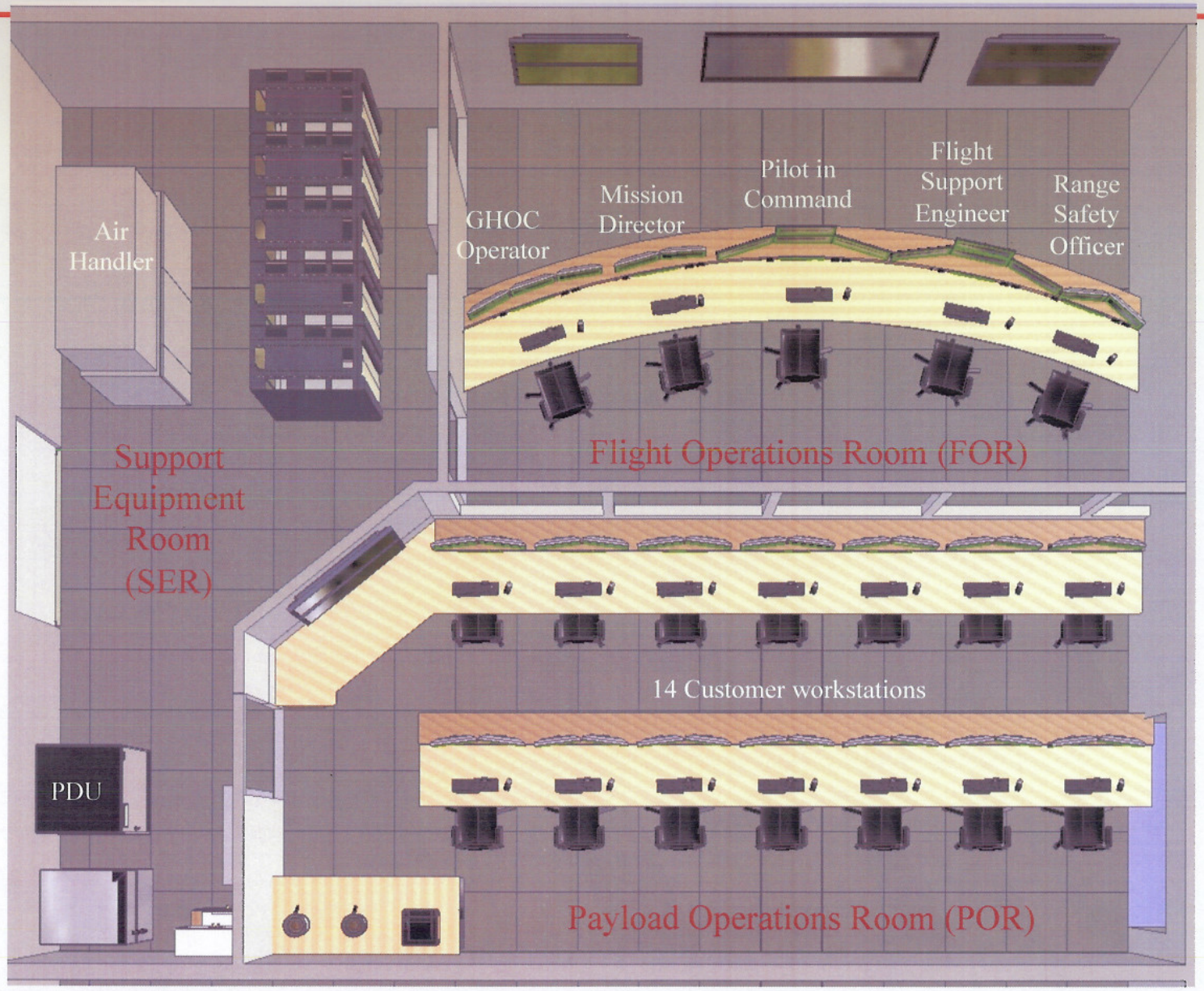


NASA Global Hawk Operations Overview

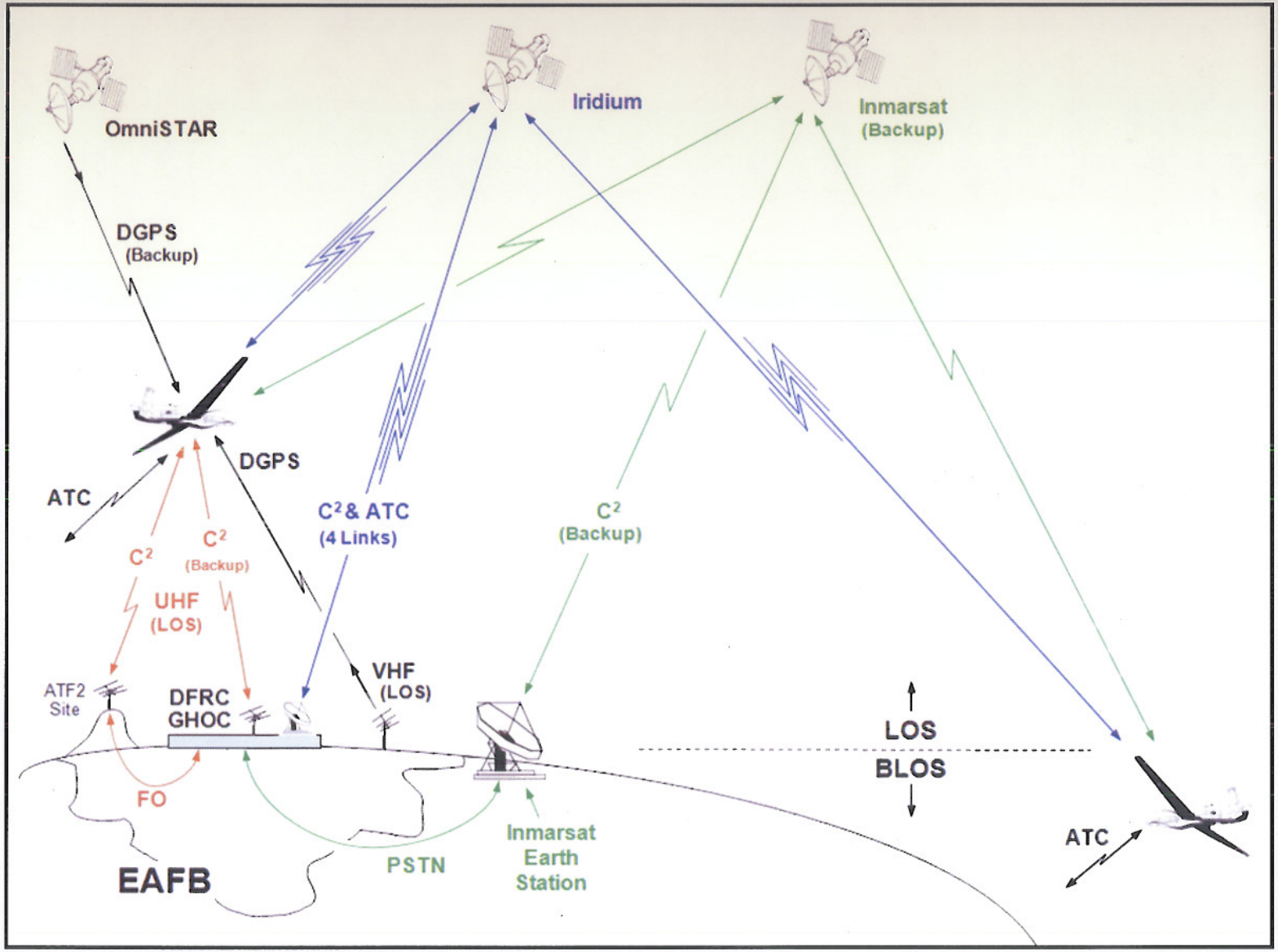
NASA Dryden Flight Research Center



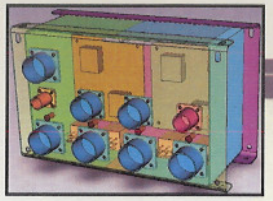
Global Hawk Operations Center (GHOC)

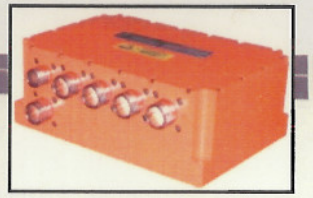


Flight Control and Air Traffic Control Communications Architecture

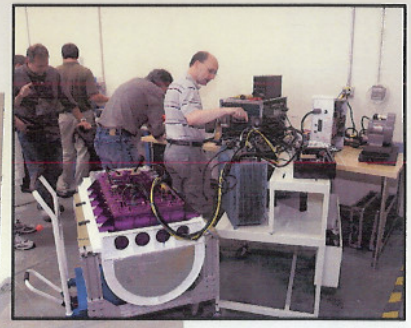


Payload Integration and Accommodations

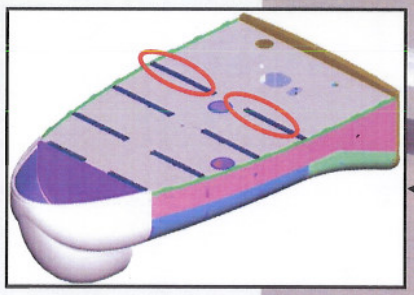




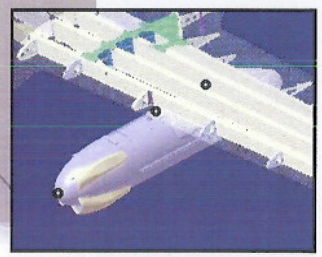
Experiment Interface Panel & Ethernet Switch (6 pairs in the aircraft)



Payload Integration Software T&E

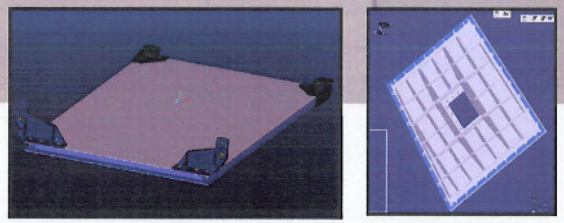


Mounting Rails

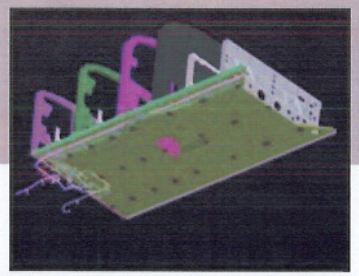


Wing Pods (future capability)

Bay Under the Nose



Pallets and Hatches

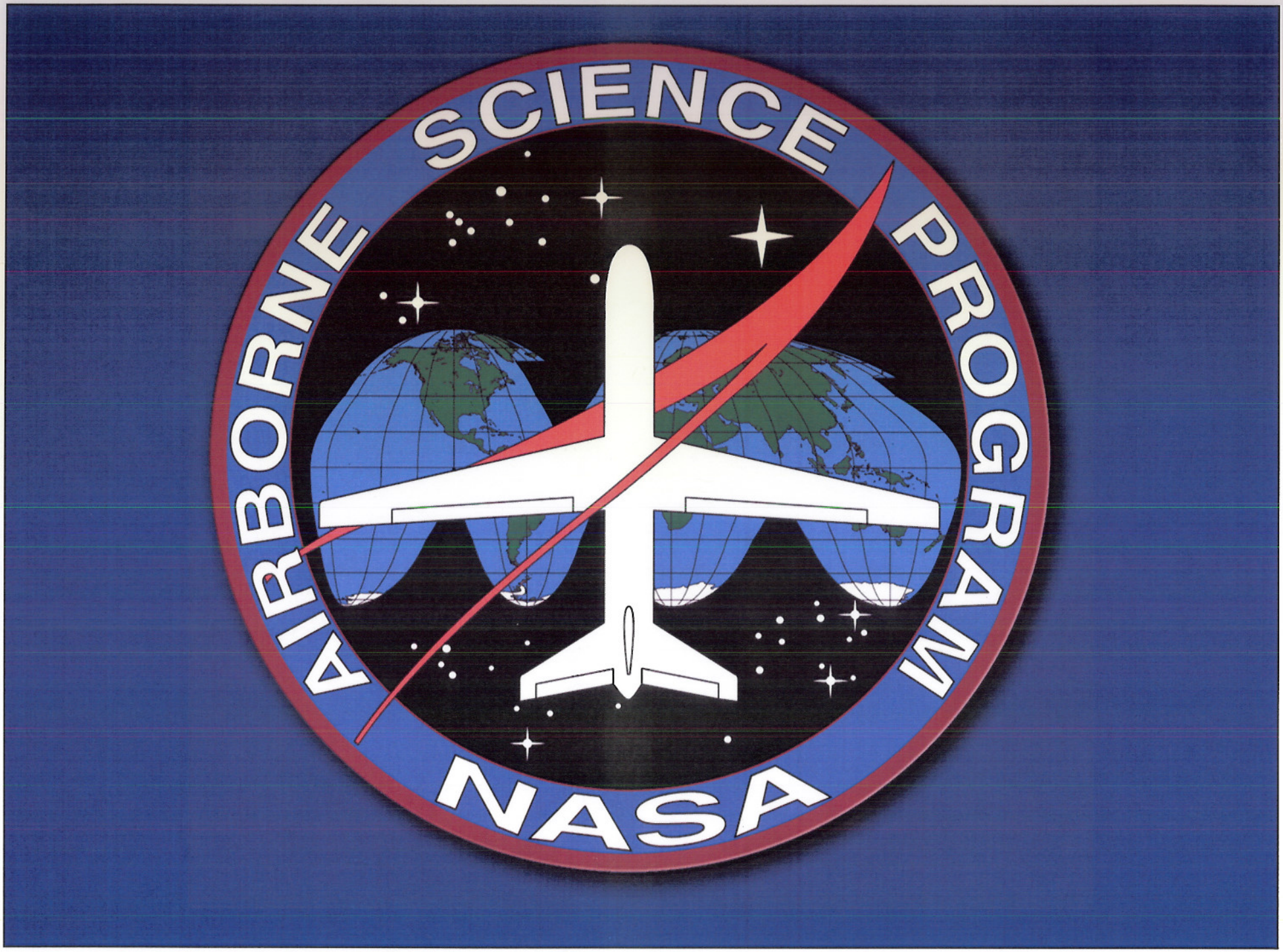


Mounting Hard Points

Payload Integration and Accommodations (cont)

On-Site Customer Accommodations

- Re-configurable work area in the hangar.
- Access to meeting room, phones, fax, copy machine, printer.
- Wireless internet.
- Shop support.
- Environmental testing support.
- NASA and Northrop Grumman Mechanics and Technicians.
- Hangar is networked to the Global Hawk Operations Center.


AIRBORNE SCIENCE PROGRAM
NASA

NASA/NOAA Partnership

NOAA and NASA Partnership

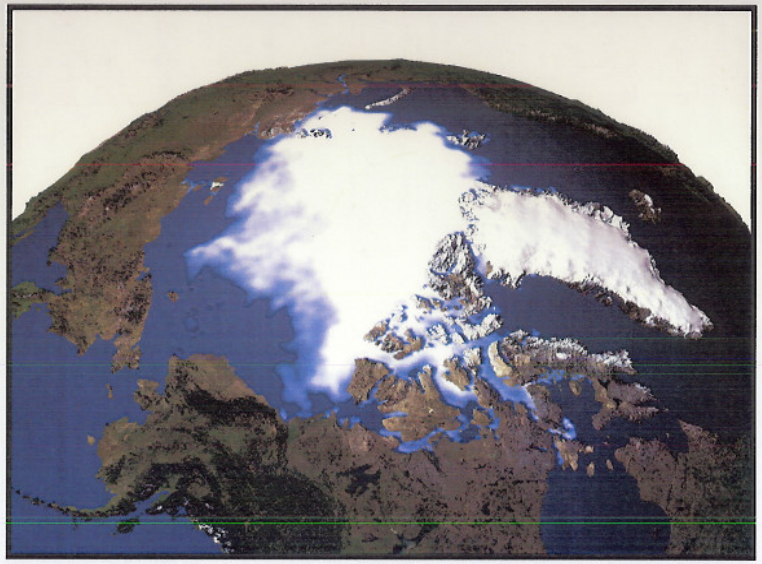
- Joint participation in science data gathering missions.
- NOAA provides scientific instrumentation to compliment NASA instrumentation.
- 3 year agreement.

CDR Phil Hall on 4 Year Detail to Dryden

- Deputy Project Manager.
- Global Hawk pilot.
- Mission planning and coordination.

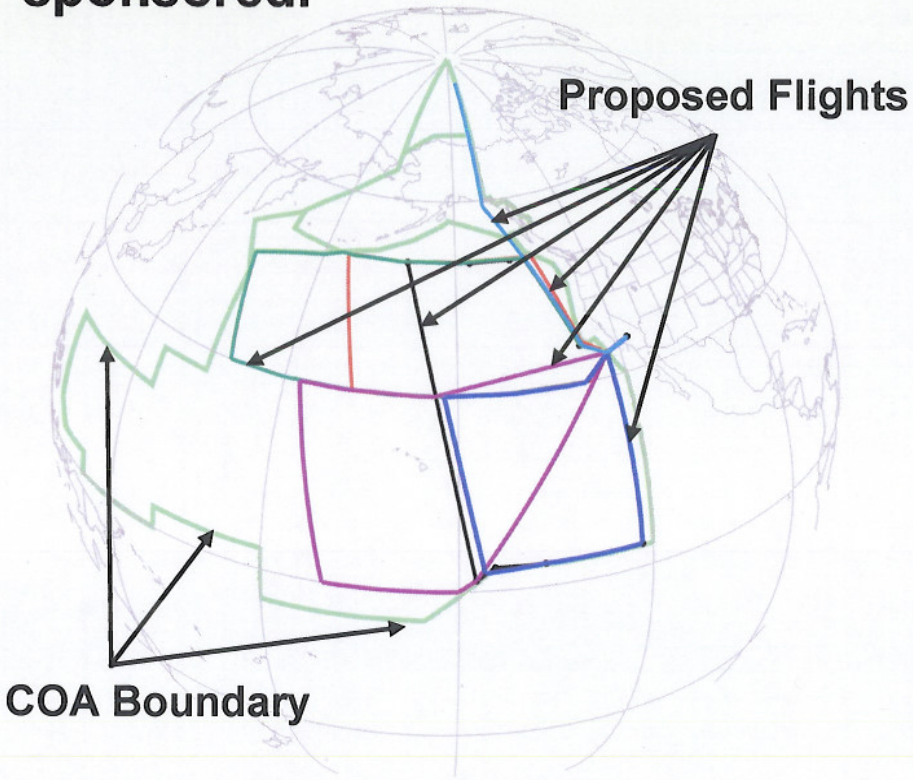
Dropwindsonde Capability

- NOAA is funding the development of a dropwindsonde capability.
- NCAR/NOAA partnership.

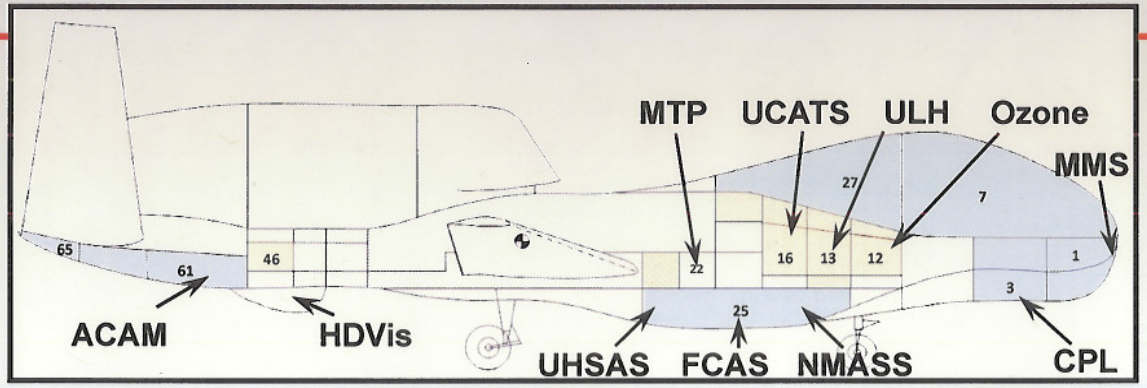


Global Hawk Pacific Science Campaign (GloPac)

- Flights planned for Winter 2010.
- Flights will be conducted over the Pacific Ocean, and possibly over parts of the Arctic.
- 11 instruments, NASA and NOAA sponsored.



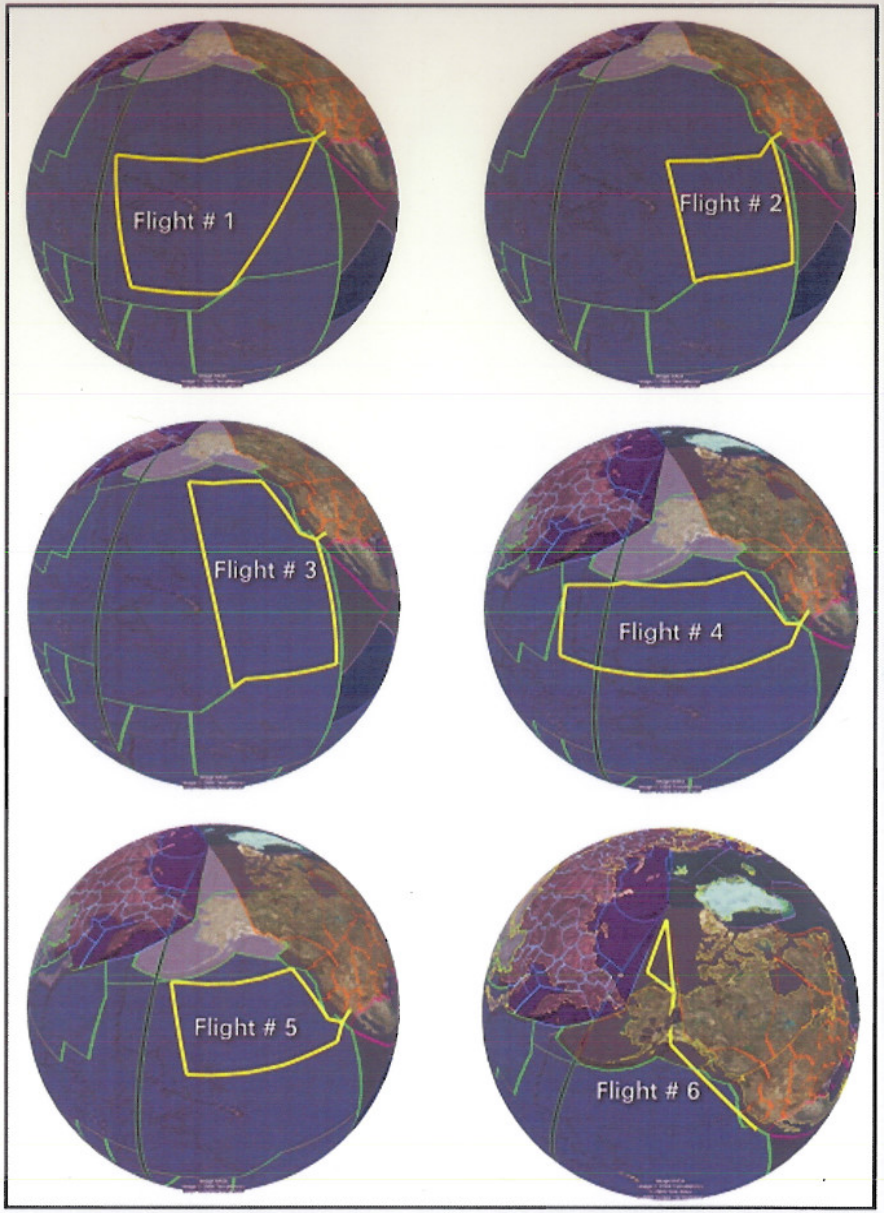
Global Hawk Pacific (GloPac) Payloads



1) Airborne Compact Atmospheric Mapper (ACAM) -- Cross-track scanning spectrographs of NO_2, O_3, & aerosols.
2) Cloud Physics LIDAR (CPL) -- Backscatter LIDAR for hi-res profiling of clouds & aerosols.
3) Focused Cavity Aerosol Spectrometer (FCAS) -- Aerosol size and concentration measurements.
4) Meteorological Measurement System (MMS) -- Science quality aircraft state variable measurements.
5) Microwave Temperature Profiler (MTP) -- Passive microwave radiometer meas. of O_2 thermal emissions.
6) HiDef Video System (HDVis) -- Time-lapse nadir color digital imagery with georeferencing.
7) Nuclei-mode Aerosol Size Spectrometer (NMASS) -- Aerosol size and concentration measurements.
8) NOAA UAS Ozone (Ozone) -- Dual-beam UV photometer for accurate O_3 measurements.
9) UAS Chromatograph for Atmospheric Trace Species (UCATS) -- Dual gas chromatographs for N_2O, SF_6, H_2, CO, & CH_4 meas.
10) Ultra-High Sensitivity Aerosol Spectrometer (UHSAS) -- Ultra-high sensitivity aerosol spectrometer.
11) UAS Laser Hygrometer (ULH) -- In-situ hi-accuracy atmospheric water vapor measurements.

Science Objectives and Missions

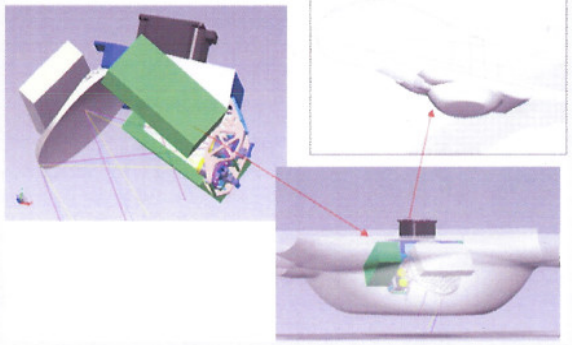
- First demonstration of the Global Hawk unmanned aircraft system (UAS) for NASA and NOAA Earth science research and applications.
- Validation of instruments on-board the Aura satellite.
- Exploration of trace gases, aerosols, and dynamics of remote upper Troposphere / lower Stratosphere regions.
- Sample polar vortex fragments and atmospheric rivers.
- Risk reduction for future missions that will study hurricanes and atmospheric rivers.



Proposed Payloads

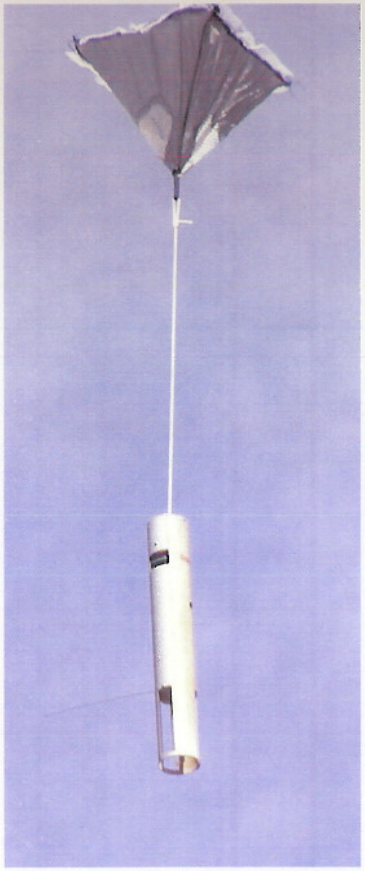
UAV-SAR(JPL)

Reconfigurable polarimetric L-band SAR designed for repeat pass deformation measurements (currently on NASA G III).

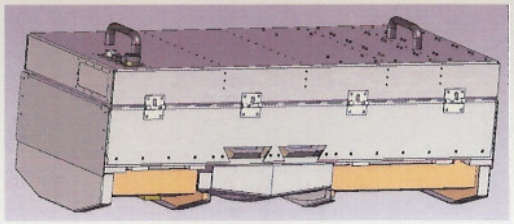


HIWRAP (GSFC)

Ku and Ka band radar for the measurement of wind and rain profiles.

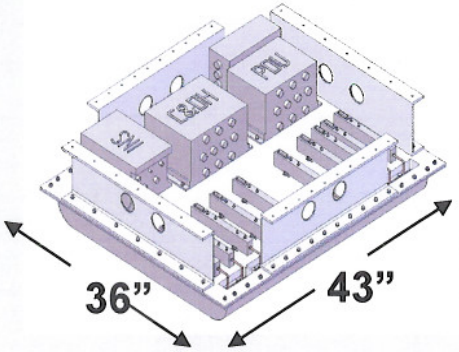


Dropwindsonde Dispenser (NOAA)



HAMSR (JPL)

Microwave Sounder providing 3D measurements of temperature and Water vapor content.

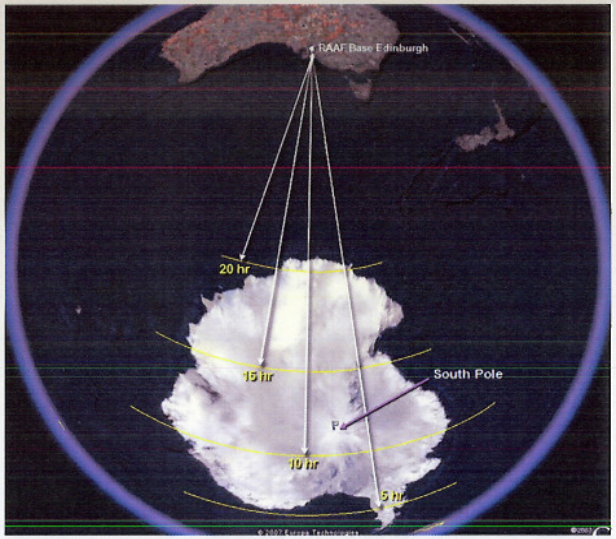


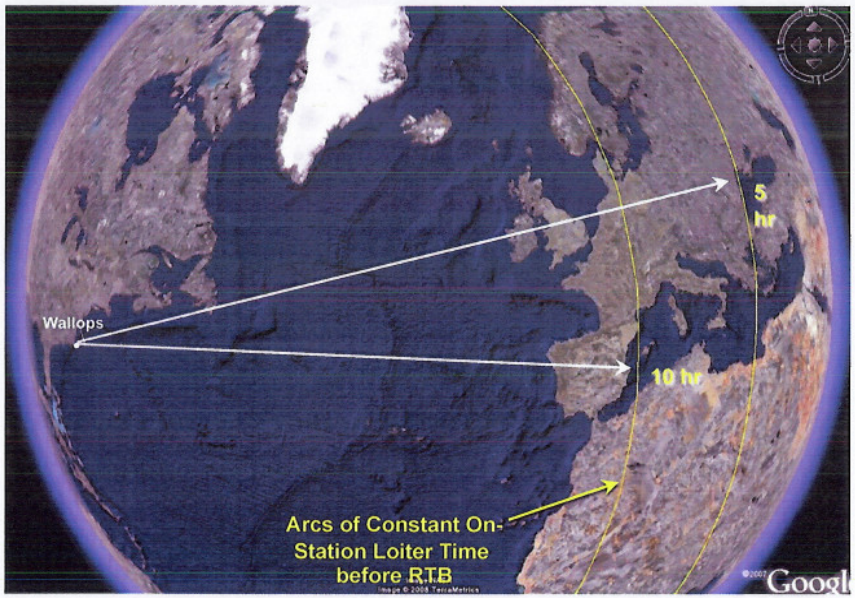
HIRAD (MSFC)

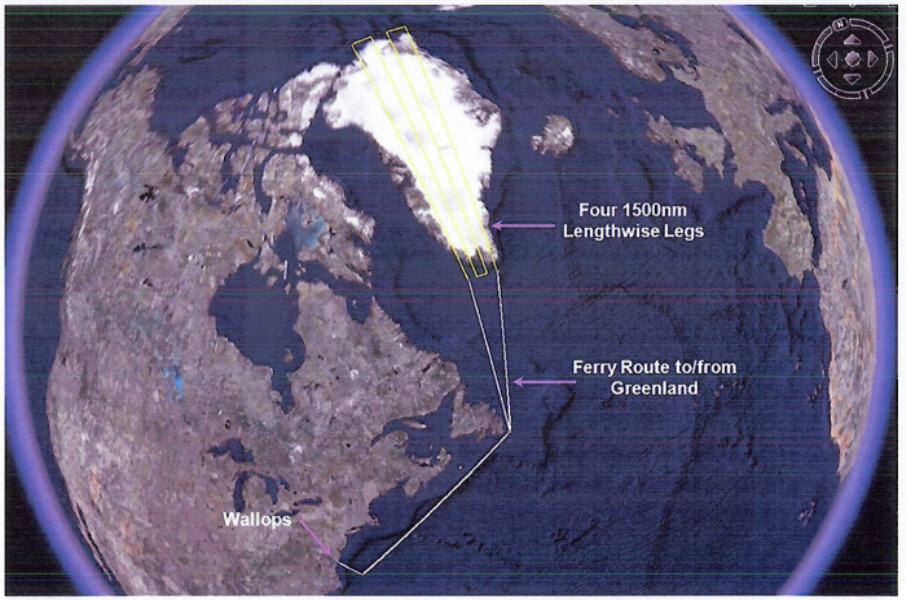
Hurricane Imaging Radiometer for high resolution measurements of ocean surface vector winds.

Future Mission Capability

With a Portable Ground Station







Summary

- NASA Dryden owns two Global Hawk aircraft, soon to be three.
- A ground control station has been constructed and certified.
- Flights within the EAFB range began in October 2009.
- Customer flights begin in 2010.

For more information:

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